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FLOOD INSURANCE STUDY

CITY OF WASHINGTON, MISSOURI

FRANKLIN COUNTY

MAY 3, 1982

Federal Emergency Management Agency

COMMUNITY NUMBER - 290138

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Flood Boundary and Floodway Map Index
Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

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FLOOD INSURANCE STUDY

CITY OF WASHINGTON,
FRANKLIN COUNTY, MISSOURI

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Washington, Franklin County, Missouri, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the City of Washington to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers, St. Louis District, for the Federal Emergency Management Agency, under Inter-Agency Agreement No. IAA-H-9-79, Project Order No. 36 and 2nd Amendment. This study was completed in February 1981.

1.3 Coordination

At the request of the Consultation Coordination Officer (CCO), the first community meeting was held on November 29, 1978 to explain the nature and purpose of the Flood Insurance Study and was attended by representatives of the City of Washington, FEMA and the U.S. Army Corps of Engineers (COE-Study Contractor).

On April 1, 1981, the results of the hydrologic and hydraulic analyses were reviewed at an intermediate CCO meeting attended by representatives from the City of Washington, FEMA and the Study Contractor.

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On December 1, 1981, the results of the work by the Study Contractor were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Washington, Franklin County, Missouri. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction for the next five years, through February 1986.

Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards as identified at the initiation of the study. The scope and methods of study were proposed to and agreed upon by FEMA and the City of Washington.

The limits of detailed studies in the City of Washington were first determined by representatives of FEMA, the COE and the City of Washington during the meeting on November 29, 1978.

In accordance with discussions held with city officials, flooding caused by the following streams was studied by detailed methods: Busch Creek from the southwestern corporate limits along Missouri Highway 100 to the confluence with Dubois Creek; Southwest Branch Busch Creek from the soutwestern corporate limits south of Missouri Highway 100 to the confluence with Busch Creek; South Branch Busch Creek from the southern corporate limits to the confluence with Busch Creek; Dubois Creek along the eastern corporate limits to the convergence with the Missouri River; St. Johns Creek along the northwestern corporate limits; and the Missouri River within the corporate limits. Reaches for these streams of detailed study were those with substantial existing flood plain development or with significant potential for future development before 1986. Three other small streams, Southwest Tributary of Busch Creek, 5th Street Creek, and City Park Creek were studied by approximate methods.

2.2 Community Description

The City of Washington is located in north-central Franklin County, Missouri and is surrounded by the unincorporated areas of the county. It is approximately eight miles north of the City of Union and 50 miles west of the City of St. Louis, Missouri. The City of Washington covers an area of approximately six square miles. The city's population is now over 8,500 and is expected to increase (Reference 1). Transportation routes through the community include State Highways 47 and 100 and the Missouri Pacific Railroad.

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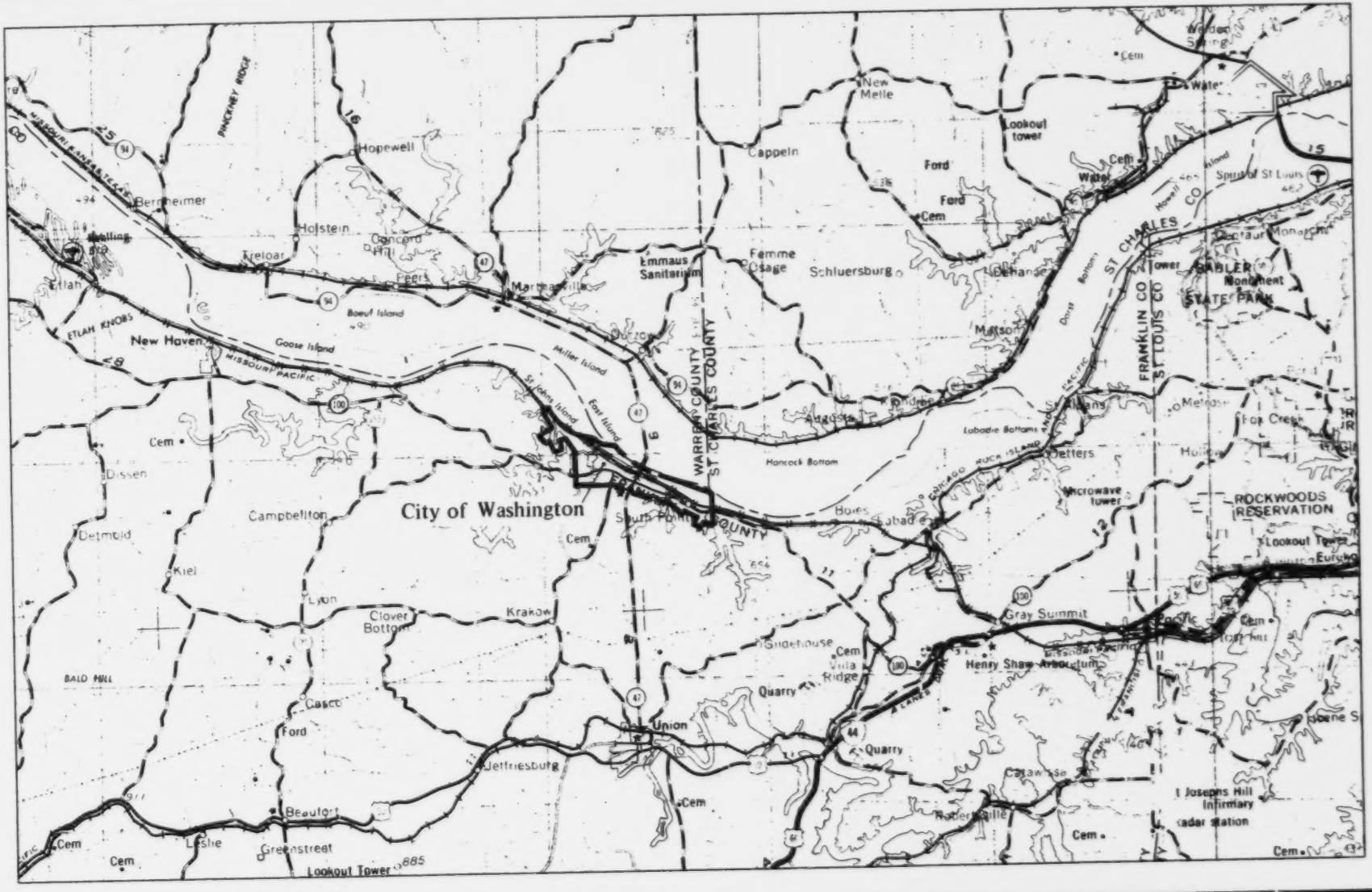

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WASHINGTON, MO
(FRANKLIN CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

The earliest record of a settlement in the Washington area was in 1794, when William Hughes located on Dubois Creek near what is now the City of Washington. The city came into being as a boat landing site and was originally referred to as "Washington Boat Landing". William G. Owens bought a ferry and the land about it in the 1820's; following his death in 1834, the project of laying out a town was continued by Owens' wife and son-in-law, John F. Mense. The City of Washington was incorporated by Lucinda Owens on May 29, 1839. The pioneers were soon joined by German immigrants and the completion of the railroad in 1855 spurred even further growth (Reference 2).

The City of Washington soon became a trade and manufacturing center. Early products of manufacturing were derived from local raw materials and were distributed primarily within the local area. The City of Washington was the birthplace of the corncob pipe process and the mass production of these pipes began in 1872. Presently, the City of Washington is the site of many small industries. There are 10 businesses that employ more than 100 people and over 25 that employ less than that amount (Reference 3).

The climate is temperate and humid with an average temperature about 56 degrees Fahrenheit (F.). Temperature extremes have ranged from -33 degrees F. to 115 degrees F. Annual precipitation averages approximately 36 inches, distributed fairly evenly throughout the year. Monthly precipitation will vary from approximately one to 1.5 inches per month in December, January and February, to 4.5 inches per month in May, June and September. Snowfall accumulation is usually 16 to 17 inches per year (Reference 2).

The City of Washington is underlain by dolomitic rocks of the Jefferson City, Cotter, Powell and Smithville formations. These dolomites are interbedded with subordinate amounts of shale, chert and sandstone. The rocks are generally flat-lying and are not part of any regional geologic folded or faulted system. The topography in the area is one of rolling hills. The surrounding land is mostly woods and brushland. There is not a large amount of farming partially due to rocky soil. The topsoil is loessial but the subsoil is clayey and moderately impervious to water (Reference 4). The "bottomland" soil consists of unconsolidated sand, silt and clay.

The vegetation along the watercourses varies from woods and brushland to parks and residential lawns to almost no vegetation at all in some industrial areas.

Within the city, approximately three per cent of the land is used for industry, four per cent for railroads, four per cent for commercial and public buildings, five per cent for parks and playgrounds, 12 per cent for water areas, 15 per cent for streets and alleys, 17 per cent for residential dwellings and 40 per cent is vacant land (Reference 2).

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2.3 Principal Flood Problems

Much of the City of Washington is situated in the upland area above the flood plain of the Missouri River. Busch Creek, St. Johns Creek, Dubois Creek and their tributaries also have flood plain areas within the corporate limits.

The community has experienced flooding from the Missouri River and the tributary streams that flow through the community.

Records dating back to 1844, indicate flood heights on the Missouri River at Hermann, Missouri, which is about 30 miles upstream of Washington, have exceeded flood stage many times. The 1973 flood, which was the highest in the last several years, was considered a 25-year event at Hermann. The 1951 flood had a peak discharge of 618,000 cubic feet per second (cfs) and was estimated to be approximately the 100-year event. In the past 25 years, serious flooding occurred along the Missouri River in this area during the following years: 1951, 1952, 1958, 1960, 1961, 1972 and 1973 (Reference 5). No records are available of flash flooding from the smaller creeks in Washington.

2.4 Flood Protection Measures

A levee is located along St. Johns Creek near West Main Street; however, it does not provide any flood protection. No other flood protection measures exist within the study area.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 per cent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one per cent chance of annual occurrence) in any 50-year period is about 40 per cent (four in ten), and for any 90-year period, the risk increases to about 60 per cent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

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3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

For the Missouri River, discharges were computed from flow records at the Hermann, Missouri U.S. Geological Survey (USGS) gage No. 06934500, record years 1898 to 1960. A log-Pearson Type III analysis was performed on gage data with modification to the data; the analysis was performed taking into account all the reservoirs currently in operation on the Missouri River (Reference 6).

For Busch Creek and South Branch Busch Creek, peak discharges for the 10-, 50-, 100- and 500-year recurrence intervals were developed by using the COE HEC-1, Flood Hydrograph Package computer program (Reference 7). Rainfall values for the 10-, 50- and 100-year recurrence interval were developed by frequency rainfall analysis from the U.S. National Weather Service Technical Paper No. 40 (TP-40) (Reference 8). Rainfall values for the 500-year recurrence interval were determined by extrapolating rainfall data from TP-40.

Peak discharges for the Missouri River were developed by the Kansas City District COE. Peak discharges for the lower portion of Busch Creek, Southwest Branch Busch Creek, Dubois Creek and St. Johns Creek were computed by Booker Associates, Inc., for the Franklin County Flood Insurance Study (Reference 9) using the USGS publication "Techniques for Estimating Magnitude and Frequency of Missouri Floods" (Reference 10).

The peak discharges computed for Busch Creek and South Branch Busch Creek were used in the COE HEC-2 Water-Surface Profiles computer program (Reference 11) to develop the necessary frequency profiles.

Peak discharges for the areas studied by approximate methods were developed using regional regression equations.

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along each flooding source studied in detail.

The Missouri River cross sections were obtained from two-foot contour mapping at a scale of 1:4800 (Reference 12) and supplemented by hydrographic surveying of the channel. Eleven bridges along Busch Creek and South Branch Busch Creek were surveyed. Cross sections between bridges were obtained through photogrammetric methods.

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TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA SQ MILES	PEAK DISCHARGES (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
BUSCH CREEK					
Upstream of confluence with Southwest Branch Busch Creek	3.5	1,750	2,900	3,400	4,400
Camp Street	2.9	1,650	2,650	3,100	4,000
Missouri Highway 47	2.5	1,450	2,400	2,800	3,600
Sunnyside Street	2.2	1,350	2,200	2,550	3,250
About 1,100 feet downstream of Stafford Street	1.6	1,100	1,850	2,100	2,650
Missouri Highway 100	0.6	400	650	800	950
SOUTH BRANCH BUSCH CREEK					
At mouth	2.7	1,325	2,200	2,550	3,300
MISSOURI RIVER					
At Hermann	528,200	405,000	555,000	620,000	820,000
SOUTHWEST BRANCH BUSCH CREEK					
At mouth	5.3	1,700	2,550	2,950	3,950
Missouri Highway 47	4.3	1,600	2,500	2,850	3,900
DUBOIS CREEK					
At mouth	34.2	6,300	9,700	11,000	15,000
ST. JOHNS CREEK					
Chicago-Rock Island and Missouri Pacific Railroad bridge	85.4	7,000	10,000	11,500	15,000

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Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map.

Channel roughness factors (Manning's "n") for the hydraulic computations were assigned on the basis of field inspection of flood plain areas. Average roughness values used for the Missouri River channel were 0.019 and 0.05 for the overbank. For Busch Creek and South Branch Busch Creek, roughness coefficients ranged from 0.03 to 0.06 for the channel and 0.02 to 0.15 for the overbanks. For the lower portion of Busch Creek, Southwest Branch Busch Creek, Dubois Creek and St. Johns Creek, roughness coefficients ranged from 0.03 to 0.10 for the channel and 0.03 to 0.18 for the overbanks.

For the Missouri River, starting water-surface elevations were determined through use of an on-going, concurrent study of the entire river being conducted by the COE. For Busch Creek and South Branch Busch Creek, the backwater profiles were initiated using the slope-area method in the HEC-2 computer program (Reference 11). Starting water-surface elevations and profiles for the lower portion of Busch Creek, Southwest Branch Busch Creek, Dubois Creek and St. Johns Creek were developed by Booker Associates, Inc., for the Franklin County Flood Insurance Study (Reference 9); using normal depth computations.

West Branch Busch Creek, 5th Street Creek and City Park Creek were studied by approximate methods. Normal depths for the 100-year recurrence interval floods were developed using Manning's equation and plotted with adjustments for backwater where possible.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD); elevation reference marks used in the study are shown on the maps.

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4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using the elevations determined at each cross section; between cross sections the boundaries were interpolated using topographic maps at a scale of 1:4800 (Reference 13). The mapping was done to a contour interval accuracy of two feet, which provided data for the valley cross sections to plus or minus one foot of the actual elevations.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map. Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2). A floodway is not shown for the entire reach of the Missouri River within the community due to the lack of cross sectional data necessary to compute a conveyance floodway. Portions of the floodway for Dubois Creek and St. Johns Creek lie outside the corporate limits.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
BUSCH CREEK								
A	1470	91/40[2]	1047	4.7	485.7	479.7[3]	480.7	1.0
B	3037	72	976	5.1	485.7	481.5[3]	482.3	0.8
C	4125	81	813	6.1	485.7	482.6[3]	483.5	0.9
D	5400	68	789	5.3	485.7	484.9[3]	485.5	0.6
E	5640	81	774	4.4	485.7	485.1[3]	485.6	0.5
F	7630	59	559	6.1	488.7	488.7	488.9	0.2
G	8630	81	715	4.3	492.1	492.1	492.2	0.1
H	11,235	72	385	8.0	496.4	496.4	496.5	0.1
I	11,435	121	807	3.8	502.7	502.7	502.7	0.0
J	11,850	49	404	7.7	502.9	502.9	502.9	0.0
K	12,315	98	884	3.2	506.4	506.4	506.5	0.1
L	13,285	85	704	4.0	506.8	506.8	506.9	0.1
M	13,635	69	738	3.5	508.3	508.3	508.3	0.0
N	14,515	61	378	6.7	508.8	508.8	508.9	0.1
O	14,820	40	262	9.7	511.8	511.4	512.1	0.7
P	15,255	54	366	7.0	514.0	514.0	514.3	0.3
Q	15,675	62	426	6.0	516.0	516.0	516.1	0.1
R	17,280	56	395	5.3	520.5	520.5	520.5	0.0
S	18,260	86	994	2.1	531.0	531.0	531.2	0.2
T	18,520	140	1459	1.4	531.0	531.0	531.3	0.3
U	19,285	37	429	4.9	535.1	535.1	535.1	0.0
V	20,190	71	569	3.7	535.3	535.3	535.7	0.4

[1]FEET ABOVE CONFLUENCE WITH DUBOIS CREEK
[2]TOTAL WIDTH / WIDTH WITHIN CORPORATE LIMITS
[3]ELEVATIONS WITHOUT CONSIDERING BACKWATER EFFECT FROM MISSOURI RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WASHINGTON, MO
(FRANKLIN CO.)

FLOODWAY DATA

BUSCH CREEK

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
SOUTH BRANCH BUSCH CREEK								
A	90	64	366	7.0	485.7	475.9[5]	476.5	0.6
B	325	99	792	3.2	488.6	488.6	489.3	0.7
C	910	57	676	3.8	489.0	489.0	489.8	0.8
SOUTHWEST BRANCH BUSCH CREEK								
A	2430	47	581	5.1	490.7	490.7	491.4	0.7
B	3045	116	953	3.1	491.7	491.7	492.5	0.8
DUBOIS CREEK								
A	4770[2]	233/120[4]	2065	5.3	485.7	478.4[5]	479.4	1.0
B	5570[2]	123/60[4]	2063	5.3	485.7	479.7[5]	480.7	1.0
ST JOHNS CREEK								
A	2210[3]	130/60[4]	1680	6.8	494.0	483.8[5]	484.4	0.6
B	3685[3]	159/40[4]	1519	7.6	494.0	484.7[5]	485.3	0.6
C	4620[3]	161	1940	5.9	494.0	486.1[5]	487.0	0.9
D	6020[3]	132	1532	7.5	494.0	487.8[5]	488.6	0.8
E	7370[3]	196/50[4]	2088	5.5	494.0	490.3[5]	490.6	0.3

[1]FEET ABOVE MOUTH
[2]FEET ABOVE CONFLUENCE WITH MISSOURI RIVER
[3]FEET ABOVE MISSOURI PACIFIC RAILROAD
[4]TOTAL WIDTH / WIDTH WITHIN CORPORATE LIMITS
[5]ELEVATIONS WITHOUT CONSIDERING BACKWATER EFFECT FROM MISSOURI RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WASHINGTON, MO
(FRANKLIN CO.)

FLOODWAY DATA

SOUTH BRANCH BUSCH CREEK - SOUTHWEST BRANCH BUSCH CREEK
DUBOIS CREEK - ST. JOHNS CREEK

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As shown on the Flood Boundary and Floodway Map, the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

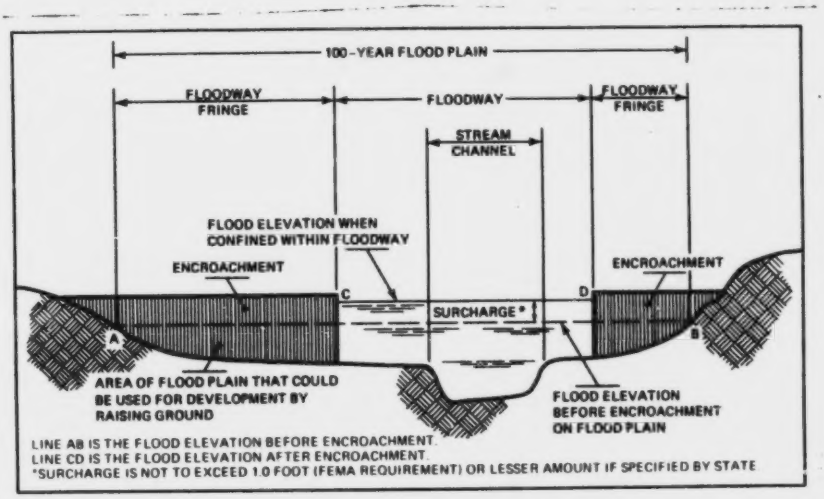
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FIGURE 2 - Floodway Schematic

The floodways in this report are recommended to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF), and flood insurance zone designations for each flooding source affecting the City of Washington.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 per cent of the reach.

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Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the City of Washington are shown on the Flood Profiles and are summarized in Table 3, "Flood Insurance Zone Data."

5.2 Flood Hazard Factors

The FHF is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the City of Washington was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A: Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations are shown or FHFs determined.

Zones A3, A4, A6, A8-A10: Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations are shown, and zones subdivided according to FHF.

Zone B: Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water

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control structure; or areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C: Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Washington is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by FEMA.

6.0 OTHER STUDIES

Flood Insurance Studies are currently in progress for the unincorporated areas of Franklin County, the City of Union, and the City of Berger (References 9, 14 and 15). This Flood Insurance Study for the City of Washington conforms to all neighboring studies.

A Flood Hazard Boundary Map has been published for the community (Reference 16). The differences between the Flood Hazard Boundary Map and this study are justified due to the more detailed nature of this Flood Insurance Study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 911 Walnut Street, Kansas City, Missouri 64106.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
MISSOURI RIVER							
REACH 1	0001,0002,0003	–4.8	–1.7	2.8	050	A10	VARIES–SEE MAP
BUSCH CREEK							
REACH 1	0002,0003	–3.2	–0.9	1.5	030	A6	VARIES–SEE MAP
REACH 2	0002,0003	–4.5	–1.7	3.2	045	A8	VARIES–SEE MAP
REACH 3	0002	–2.8	–0.7	1.4	030	A6	VARIES–SEE MAP
REACH 4	0002	–4.2	–0.9	1.9	040	A8	VARIES–SEE MAP
SOUTH BRANCH BUSCH CREEK							
REACH 1	0003	–1.7	–0.5	0.8	015	A3	VARIES–SEE MAP
SOUTHWEST BRANCH BUSCH CREEK							
REACH 1	0002,0003	–2.2	–0.5	1.3	020	A4	VARIES–SEE MAP

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WASHINGTON, MO
(FRANKLIN CO.)

FLOOD INSURANCE ZONE DATA

MISSOURI RIVER - BUSCH CREEK
SOUTHWEST BRANCH BUSCH CREEK - SOUTH BRANCH BUSCH CREEK

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8.0 REFERENCES AND BIBLIOGRAPHY

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6. ————, Kansas City District, Frequency-Discharge Curve, Missouri River at Hermann, Missouri, March 1975.

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8. U.S. National Weather Service, Technical Paper No. 40, Rainfall Intensity-Duration-Frequency Curves, Washington, D.C.: U.S. Government Printing Office, 1961.

9. Federal Emergency Management Agency, Flood Insurance Study, Unincorporated Areas of Franklin County, Missouri, (in progress).

10. U.S. Coast and Geodetic Survey, Techniques for Estimating Magnitude and Frequency of Missouri Floods, Leland D. Hout, 1966.

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12. ————, Kansas City District, Aerial Photographs, Scale 1:4800, Contour Interval two feet: St. Charles and St. Louis Counties, Missouri, 1974, 1975 and 1976.

13. ————, St. Louis District, Aerial Photography, Scale 1:4800, Contour Interval two feet: Walker and Associates, Fenton, Missouri, "City of Washington", 1979.

14. Federal Emergency Management Agency, Flood Insurance Study, City of Union, Missouri, (in progress).

15. ————, Flood Insurance Study, City of Berger, Missouri, (in progress).

16. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of Washington, Missouri, Revised October 1976.

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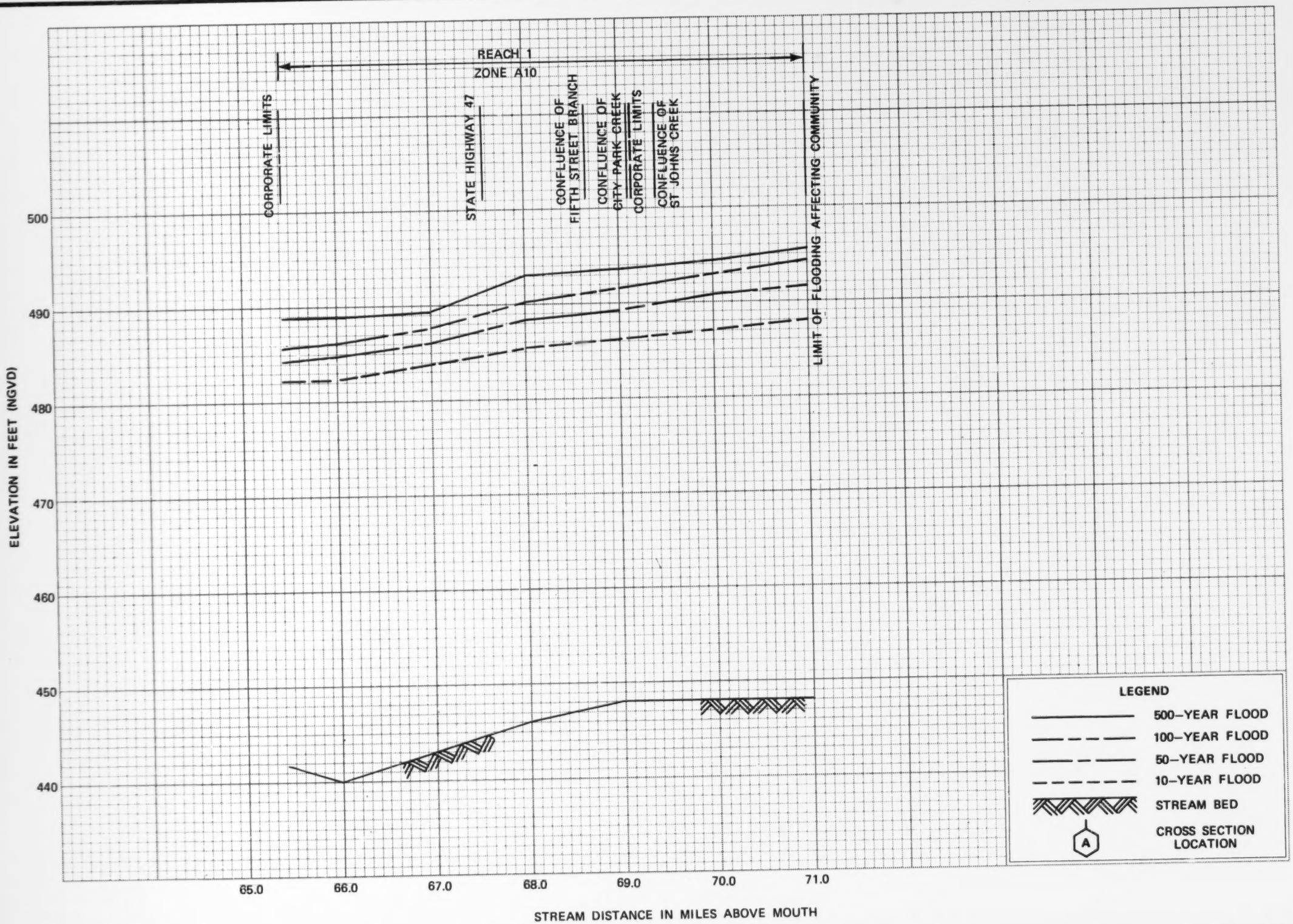


FLOOD PROFILES

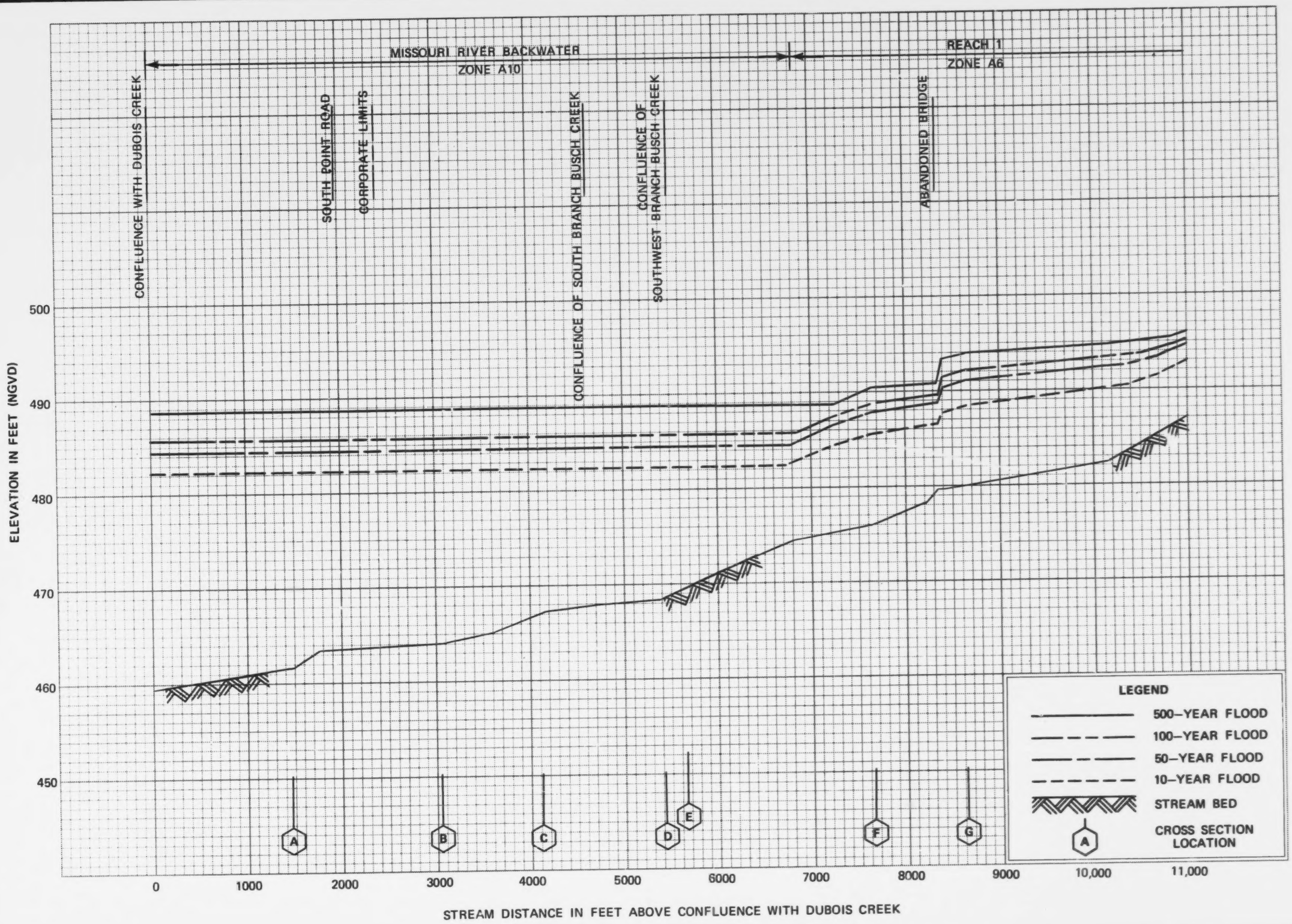
MISSOURI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WASHINGTON, MO
(FRANKLIN CO.)

01P.

DOCUMENT AVAILABLE



FLOOD PROFILES

BUSCH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WASHINGTON, MO
(FRANKLIN CO.)

02P

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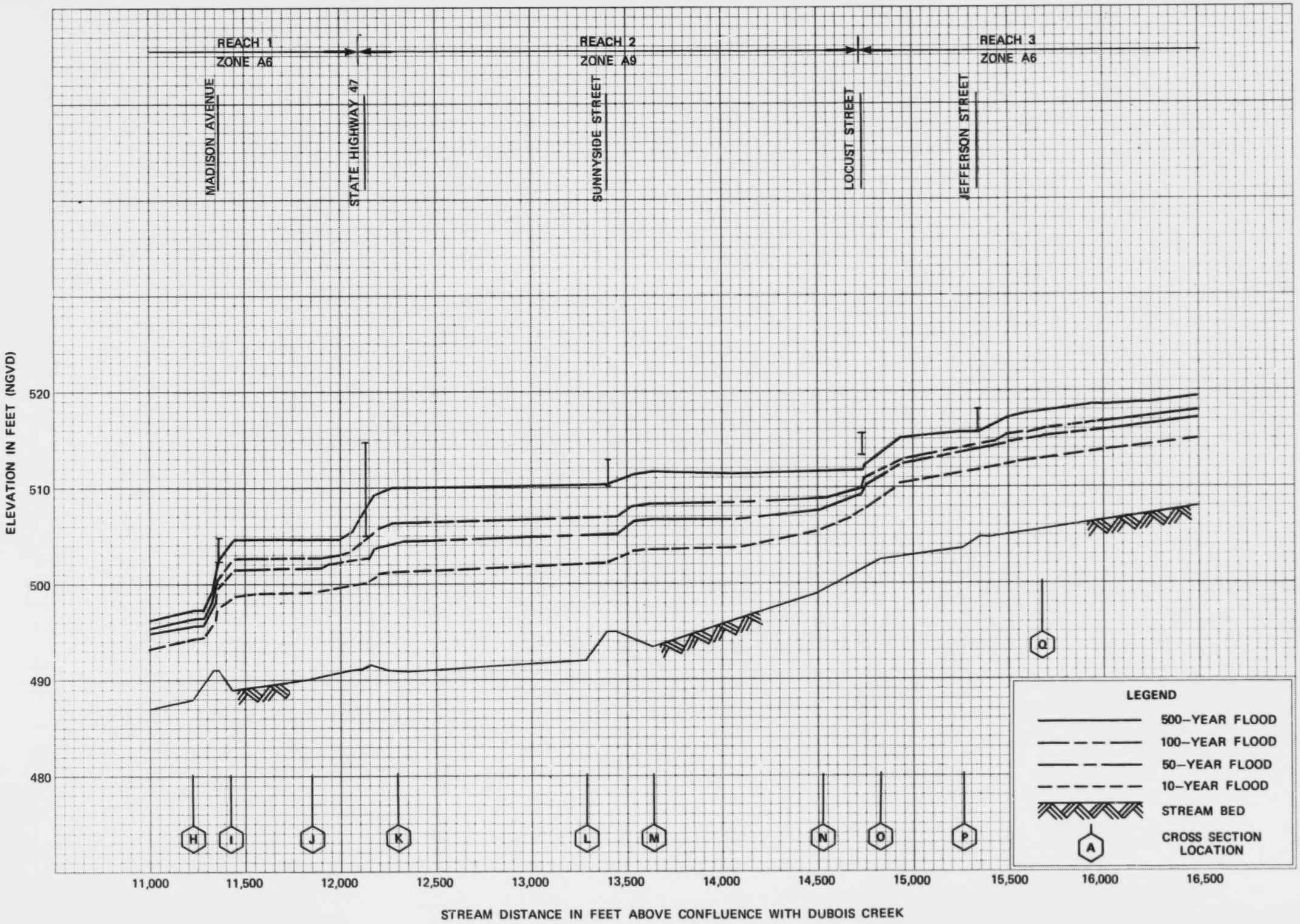

FLOOD PROFILES

BUSCH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WASHINGTON, MO
(FRANKLIN CO.)

03P

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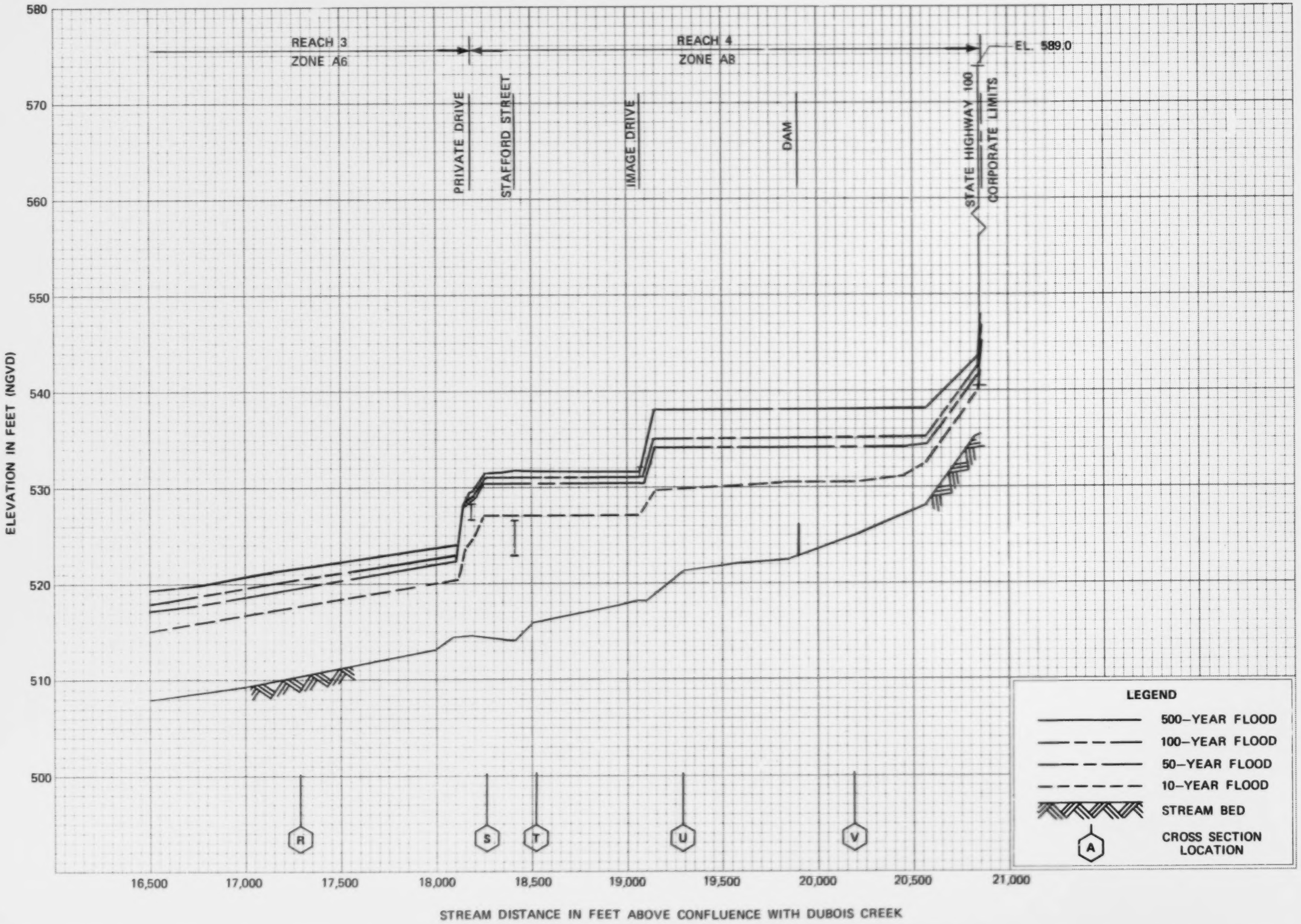

FLOOD PROFILES

BUSCH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WASHINGTON, MO
(FRANKLIN CO.)

04P

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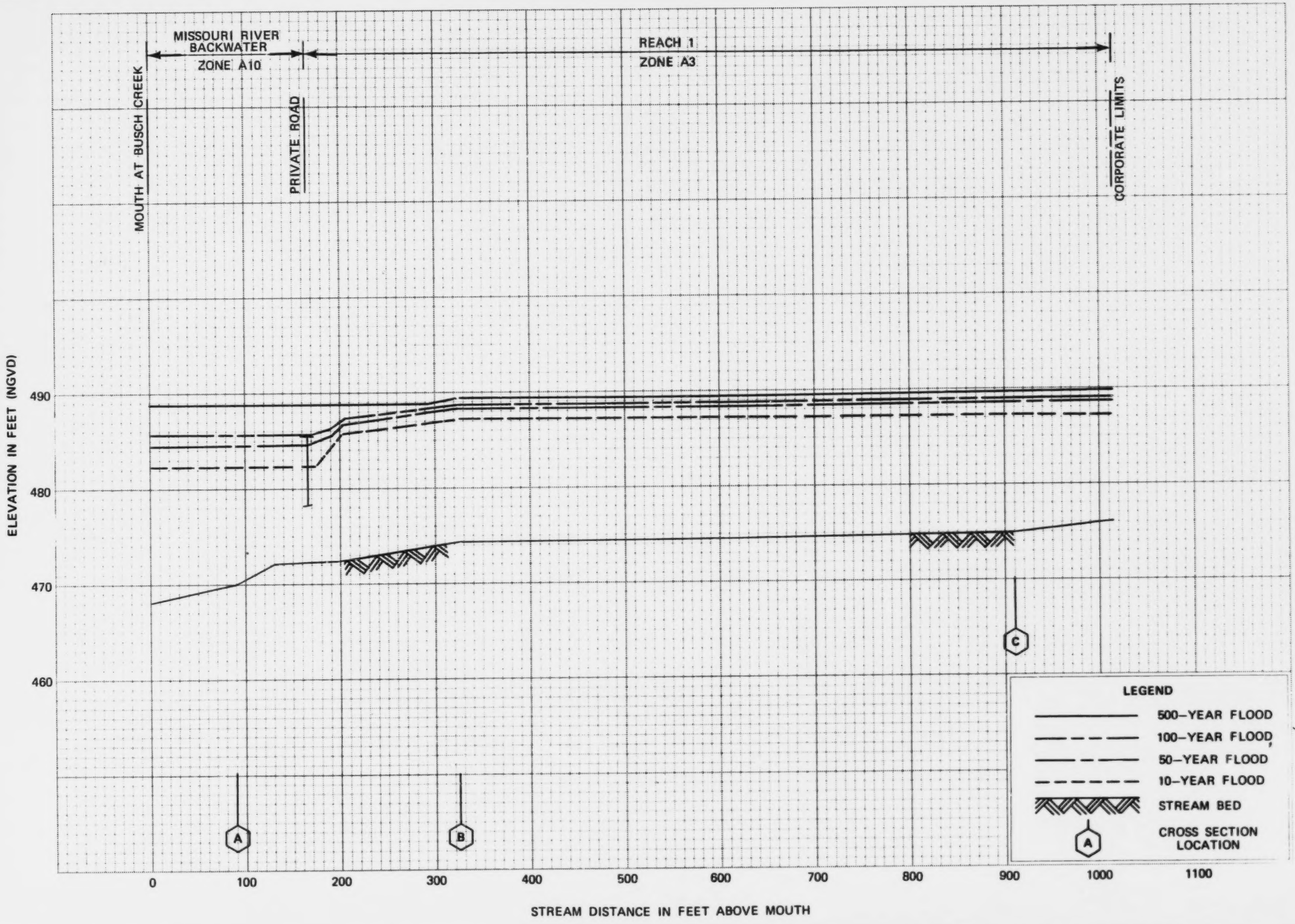

FLOOD PROFILES

SOUTH BRANCH BUSCH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WASHINGTON, MO
(FRANKLIN CO.)

05P

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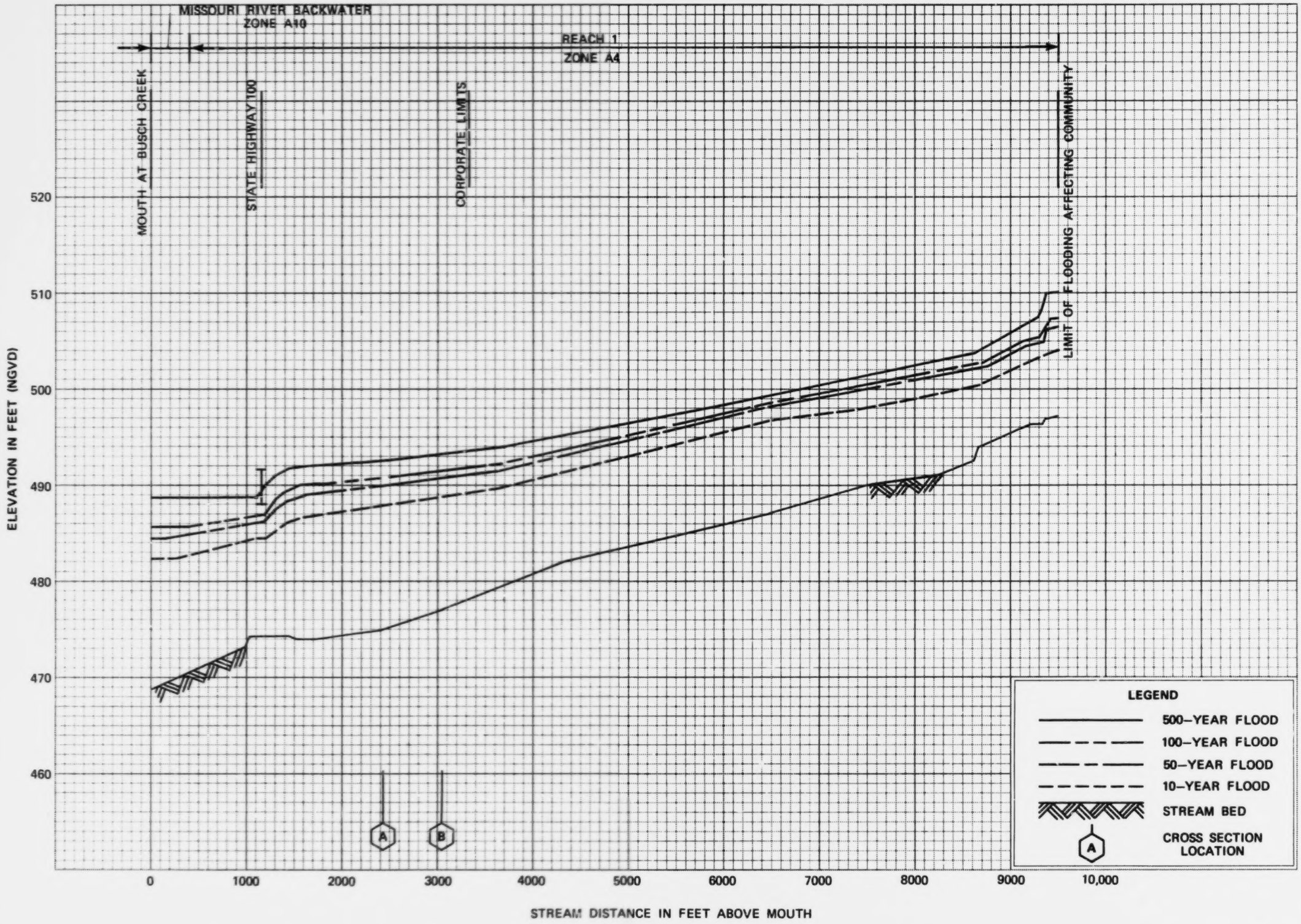

FLOOD PROFILES

SOUTHWEST BRANCH BUSCH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WASHINGTON, MO
(FRANKLIN CO.)

06P

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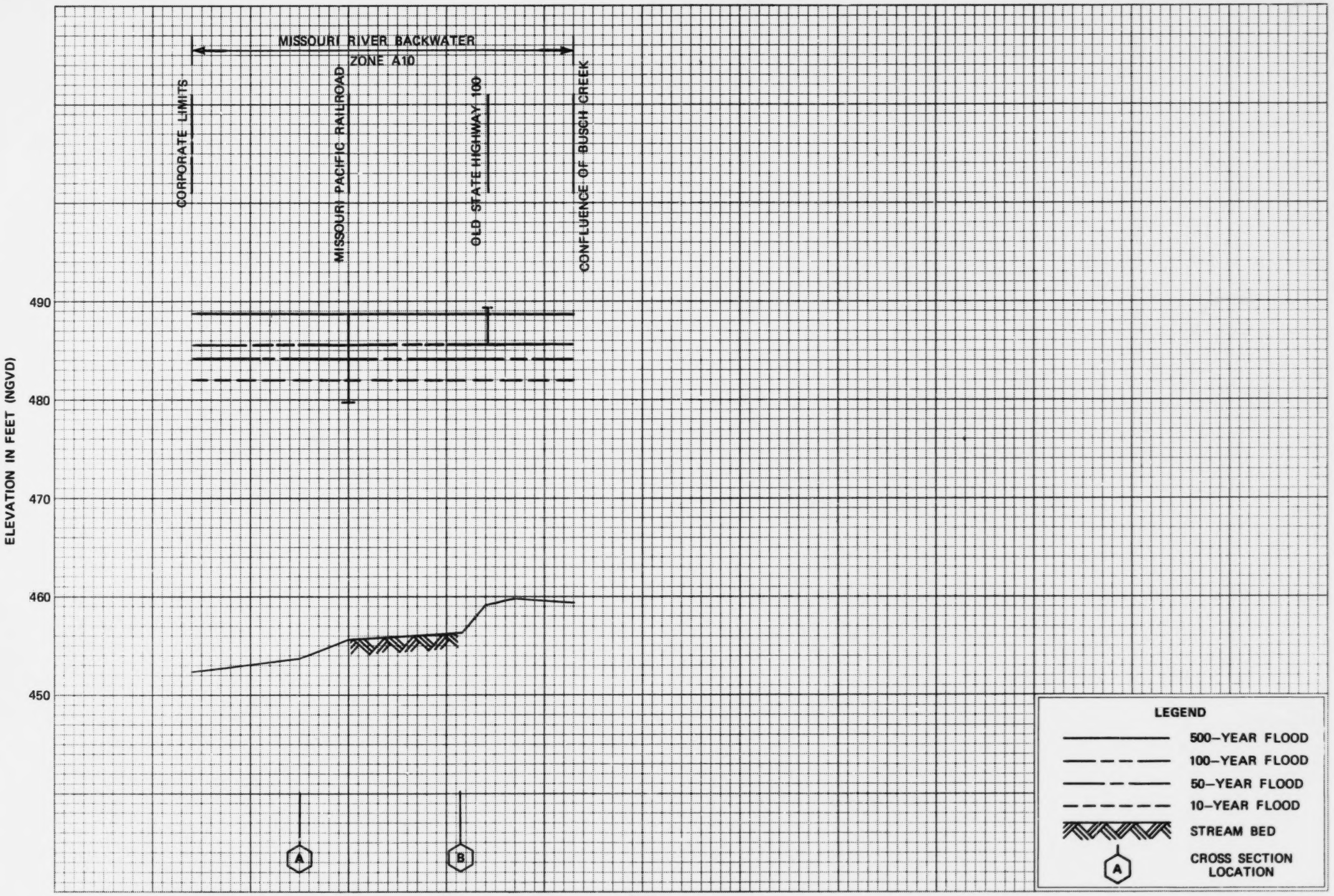

FLOOD PROFILES

DUBOIS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WASHINGTON, MO
(FRANKLIN CO.)

07P

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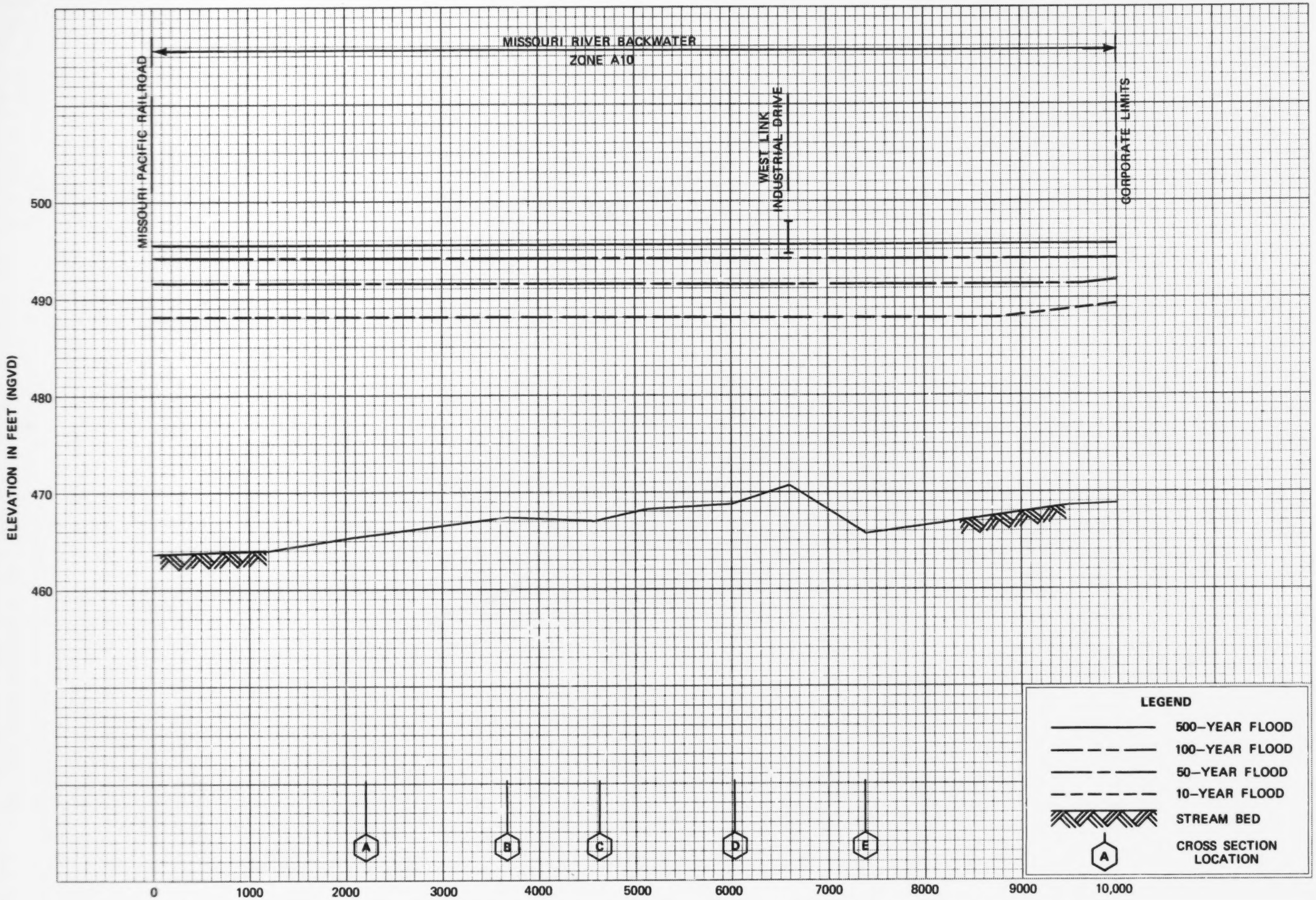

FLOOD PROFILES

ST. JOHNS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WASHINGTON, MO
(FRANKLIN CO.)

08P